

SECTION 42

RAILROAD CARRYING BRIDGE EVALUATION PROGRAM

1.42.1 EVALUATION SURVEY REPORT FORMAT - AR - (FOR RAILROAD CARRYING BRIDGES)

Note: Values in parentheses, or otherwise indicated, are in customary U. S. Units.

The report of the results of a Bridge survey and rating of an existing railroad bridge, performed by or for the Department, shall adhere to the following format:

- (A). **REPORT COVER SHEET:** The report's cover sheet shall include the bridge number, name, railroad milepost, route number, USRA. line code, municipality, county, bridge survey cycle number and the month and the year of the bridge survey (see attached sample).

The cover sheet colors for various cycles shall be: First cycle: White; Second cycle: Pink; Third cycle: Green; Fourth cycle: Yellow; Fifth cycle: Orange; Sixth cycle: Red; Seventh cycle: Blue; Eighth cycle: White; Ninth cycle: Pink; Tenth cycle: Green, etc.

The report shall be bound using a standard 3-hole punch type binding.

- (B). **LETTER OF TRANSMITTAL (CONSULTANT PROJECTS ONLY):** The letter of transmittal shall be addressed as follows (see attached sample):

Manager, Structural Evaluation and Bridge Management
New Jersey Department of Transportation
1035 Parkway Avenue
PO Box 600
Trenton, New Jersey 08625-0600
ATTN: Project Manager (Name)

Re: Bridge Survey and Rating of Bridge Number, Name, Railroad Milepost
and Route Number

In addition, the letter should include the date of the agreement with the New Jersey Department of Transportation and any disclaimer and/or restrictions on the information contained in the report and its use and the due date for the submission of the particular report (preliminary or final). Also, include a Quality Assurance Statement for the structure.

- (C). **TABLE OF CONTENTS:** One page indicating items 1 thru 11 in order shown as follows and providing the page number in the report on which each item starts. All pages in the report shall be numbered (i.e. Cycle No.- Page No.) at the bottom and centered.

Page No.

1. Maps.....	
2. Structural Data	
3. Controlling Ratings	

4. Conclusions and Recommendations	
5. Historical Information	
6. Bridge Description	
7. Appendix 1 - Structure Inventory & Appraisal Sheets	
8. Appendix 2 - Computations	
9. Appendix 3 - Drawings, Soundings and Photographs	
10. Appendix 4 - Field Notes with CADD Sketches	
11. Appendix 5 - Underwater Inspection Report/ Other Special Report if applicable	

1. **Maps:** Two maps, are required: one "General Location Map" and the other, a more detailed and specific "Local Map". Each map shall be on a separate 210 by 297 millimeter (8 1/2 by 11 inches) sheet and include the structure, name, railroad line, route number, railroad milepost and feature intersected (located in lower right corner).
 - a. **General Location Map:** For **State** owned bridges a map of the entire state of New Jersey, scale approximately 1: 1 000 000, pin pointing the location of the structure being reported on (by bridge number, name, railroad milepost and route number). This map should show railroad lines, with their USRA Line Code number and principal cities and/or towns along each line.
 - b. **Local Map:** A current map of the immediate vicinity of the reported structure; scaling 1: 20 000 with the structure centered on the page. Include roads, railroads, waterways, county and township names and a north arrow. Features intersecting the bridge should be clearly labeled.
2. **Structural Data:** A summary of findings shall be included as per the attached format. The items in this format are self-explanatory, however, further explanation for some items is provided as follows:
 - a. **Component/Material:** The components shall be as listed in Format "AR" only. Type of material used for majority of construction shall be given below the component in the same vertical column. Delete the components which are not applicable.
 - b. **Condition Rating:** The condition rating of various components shall be the overall rating of the component as per the current FHWA Recording and Coding Guide for the Structural Inventory and Appraisal of Bridges along with NJDOT Railroad Coding Instructions and should be consistent with the ratings given on field notes and SI&A sheet.
 - c. **General Remarks:** Summarize the significant defects and give a brief account of what was found during the bridge survey, as it relates to the structural integrity of the bridge. Defects for which repairs are recommended must be mentioned. Photos of these defects should be referenced in this section.

The Deck section should include the condition of the top and underside of the deck (concrete slab, ties and ballast plate), walkways, bridge railing, etc. For reinforced concrete decks give the percentage of spalled area (open or patched) and estimated contaminated area (underdeck).

The Superstructure section should include the condition of main load carrying members and diaphragms (include percent loss of section if any) and the bearings.

The Substructure section should include the condition of the abutments, pier(s), retaining walls, crash walls etc., and information on scour or undermining.

The terminology used throughout the evaluation bridge survey report for various elements shall be in accordance with the following:

Concrete: Describing concrete conditions shall be as defined and illustrated in the ACI Journal, November 1968, Report of ACI Committee 201 "Guide for Making a Condition Survey of Concrete in Service".

Steel: Describing steel conditions shall be as defined and illustrated in "Bridge Inspector's Training Manual 90" as published by the U.S. Department of Transportation, Federal Highway Administration.

Timber: Describing timber conditions shall be as defined in accordance with AREA Chapter 7, Part 1.

The Safety Features section should include the adequacy of the guard rails, guard members, alignment of approach rail, field measured minimum clearances and where they occur (minimum vertical clearance above and below the bridge, and lateral underclearance left and right as per SI&A coding requirements and AREA track clearances). For bridges over waterways, horizontal and vertical clearances of the waterway channel should also be given as per field measurements.

3. **Controlling Ratings:** In this section give the "As-Built" and "As-Inspected Ratings" of the controlling member and a speed restriction chart. The rating and chart shall be computed in accordance with the current "American Railway Engineering Association Manual for Railway Engineering", and all subsequent Interim AREA Manual specifications, and as interpreted and modified in Subsection 1.42.5, "Rating of Existing Railroad Structures". Also, comment on why the ratings are low, if it is the case, and what controlled the ratings (e.g. bending, shear, horizontal shear, etc).
4. **Conclusions & Recommendations:** Conclusions resulting from the bridge evaluation survey regarding the adequacy (structural, clearances, etc.) of the bridge and any unusual or special conditions indicating higher expenditures required to uphold rail service on a given line should be given here. Also, include possible explanations of the causes of any inadequacies found.

Make specific recommendations for safety improvements, major repair work (i.e. structure rehabilitation and/or replacement), and other repair work to correct significant defects, deteriorations and inadequacies found during this bridge survey.

The recommendations should be specific about the location of defects and the methods of repair. The recommendations for other repair work should be listed in the order of priority. Each recommendation should be referenced to the photos. For major repair/ rehabilitation work, provide cost estimates, however, for other repair work, provide quantities only.

All recommendations along with repair and/or replacement shall be based on upgrading all members to a level where inventory ratings are sufficient to sustain the maximum anticipated loading condition (Equivalent Cooper E).

In addition, list all areas of deterioration or structural members which should be inspected at frequencies of less than two years and indicate the inspection cycle in months for each area or member. Be very specific about locations to be inspected.

5. **Historical Information:** If available, this information should include when and under what agency the structure was built; when and by whom any subsequent additions or improvements to the structure, trackline, waterway channels, clearances, track changes, etc. were made. A detailed description with reference to photographs and drawings if possible should be furnished for any of the above changes. Also include, if different from current designations, the railroad and branch in use when the bridge was built.
6. **Bridge Description:** Furnish a brief description of the structure. Include the type of construction, materials in the deck, superstructure and substructure components, and important dimensions. A more detailed description should be given if plans are not available.
7. **Appendix 1 - Structure Inventory & Appraisal Sheet:** This section should contain a 210 by 297 millimeter (8 1/2 by 11 inches) computer print out of the "Structure Inventory and Appraisal Sheet" (two or more sheets for structures carrying railroads over highways). This sheet will be developed by the Department from the Computer Input sheets submitted with the preliminary report and coded in accordance with the current FHWA Recording and Coding Guide for the Inventory and Appraisal of the Nations Bridges and Recording and Coding Guide for the Structure Inventory and Appraisal of New Jersey Bridges and supplemented by the Railroad Coding Instructions. For the final report, include only the computer printout (supplied by the State).
8. **Appendix 2 - Computations:** In this section, include computations made in arriving at the various ratings given in Section 3 of the report. Include a summary as the first page of the computations listing all ratings with page number references and the allowable stresses used (see attached samples).
9. **Appendix 3 - Drawings, Soundings & Photographs:** A plan sketch indicating the direction and location of the photographs should be included. Bridge

drawings (plan, elevation and cross section) etc. and color photographs (35mm prints) plus color slides of unique defects should be included in this section of the report. Also, sounding sketches completed in accordance with the current edition of the "Underwater Inspection and Evaluation of New Jersey Bridges Guidelines Manual " should be included.

Photographs of both full elevations and track views, upstream and downstream views (if applicable), all significant defects, any repairs made and any special equipment used (Cherry Picker, maintenance and protection of traffic, special ladders, etc.) should be included in the report. The photographs should be placed in the report in the following order: Elevations, Track Views, Stream Views, Deck, Approaches, Superstructure, Substructure, Channel, Safety Features and Special Equipment.

10. **Appendix 4 - Field Notes:** Detailed clear hand written field notes using the Department's current Field Note Format for the type of structure being surveyed and/or CADD field sketches should be included as back-up data for the report. Field notes should include measurements taken during the bridge survey. A sample of the current Field Note forms and CADD sketches can be obtained from the Structural Evaluation/Bridge Management Unit.
11. **Appendix 5 Underwater Inspection:** In this section, include the diver's inspection report (if applicable) done in accordance with the current edition of the "Underwater Inspection and Evaluation of New Jersey Bridges Guidelines Manual". Also, include as additional appendices any special reports such as fatigue analysis, ultrasonic testing, chemical analysis, coupon testing, hydraulic analysis, geotechnical streambed analysis, etc. Provide photographs showing the equipment used.

Sample - For State Bridges
(Consultant Report Cover Sheet)

NEW JERSEY DEPARTMENT OF TRANSPORTATION

BRIDGE EVALUATION SURVEY REPORT OF THE

Structure No. 1609-152

Boonton Line over Rt. 80
RR MP 20.18
Route 5080
USRA Line Code 6101
Wayne Township
Passaic County

CYCLE NO. 1
AUGUST, 1996

XYZ ENGINEERS, INC.
100 Lincoln Place
East Orange, New Jersey 07018

Sample Letter of Transmittal
(Preliminary/Final Report)

Manager
Structural Evaluation and Bridge Management
New Jersey Department of Transportation
Engineering and Operations Building
1035 Parkway Avenue
PO Box 600- 5th Floor
Trenton, New Jersey 08625-0600

Attn: Mr. _____, Project Manager

Evaluation Bridge
Survey & Rating of
Structure No.
Route No.
Structure Name

Gentlemen:

In accordance with our Agreement No. _____ BI _____ with the New Jersey Department of Transportation, dated _____, we are pleased to submit this PRELIMINARY REPORT/FINAL REPORT for the above referenced bridge. A scanned and indexed report will be submitted on CD by a separate transmittal.

The report covers the results of a field inspection of the structure and recommendations for repair or replacement of major defects found. The inspection was made according to generally recognized standards and procedures, but it is not implied that all defects were or could have been disclosed by this inspection.

The inspection findings and recommendations in this report were reviewed to ensure a proper level of quality and uniformity. The report adheres to State practices for inspections and current NJDOT standards.

Consultant XYZ

(FORMAT "AR")

**STRUCTURAL EVALUATION/BRIDGE MANAGEMENT UNIT
EVALUATION BRIDGE SURVEY REPORT
FOR RAILROAD CARRYING BRIDGES**

CYCLE NO._____

STRUCTURAL DATA

Bridge No. _____ Year Built: _____
Reconstr/Widening: _____

Route No. _____ RR km (Mile) Post _____ Length: _____ Width: _____

Name: _____ Date of This
Eval.: _____

Line/Branch: _____
By: _____

USRA Line Code: _____ Date of FCM/Pin Hanger Inspection:

Structure Type: _____ By:

_____ (Only when special inspections are
applicable)

_____ Municipality: _____

_____ County: _____

Special Equipment Used: _____
(Include Photo)

Date of Underwater Insp: _____

Date of Special Testing: _____

Date of Electr./Mech. Insp.: _____
(Movable Bridges Only)

Overall Condition: _____

Component/ Material	Cond. Rating	General Remarks
_____	_____	_____

DECK

Component/
Material

Cond.
Rating

General Remarks

APPROACHES
(Condition of Rail & Track Bed)

SUPERSTRUCTURE

SUBSTRUCTURE

CHANNEL/
WATERWAY

RAILROAD
SAFETY
FEATURES

The minimum vertical underclearance is _____ under
_____.

The lateral clearances are: Left _____ Right _____.

For waterways include horizontal and vertical clearances of the main channel span.

CONTROLLING RATINGS

Controlling
Member

As
Built Inspected

As

Remarks

End
Floorbeam

Inventory Ratings

Interior
Stringer

Operating Ratings

Controlling
Live Load

Equivalent Cooper E

CONCLUSIONS AND RECOMMENDATIONS:

The overall condition of the structure is _____ due to _____.

((Give a brief description and location of the fracture members or pin-hanger details (specify when FCM's are internally redundant - i.e., riveted)).

A. If the bridge does not meet current geometry and/or load standards - Major work required:

Due to the condition of the _____ and/or inadequate _____, we recommend the following repairs and/or remedial action:

(List recommendations for major repair work with quantities and cost estimates)

In the interim, until the structure is replaced/widened/lengthened/raised/etc., the following repairs/rehabilitation should be made to retard further deterioration, preserve the structural integrity of the bridge, improve safety and extend its useful life:

(List recommendations for interim repair work with quantities only)

Or if the primary recommendation (major work) is for rehabilitation only:

We also recommend that the following interim repairs be made, until the rehabilitation is implemented, to retard further deterioration, preserve the structural integrity of the bridge, improve safety and extend its useful life:

(List recommendations for interim repair work with quantities only)

B. If the bridge meets current geometry and load standards - No major work required.

We recommend that the following repairs be made to retard further deterioration, preserve the structural integrity of the bridge, improve safety and extend its useful life:

(List recommendations for other repair work with quantities only)

Note: The following area(s) or structural member(s) should be inspected on an interim basis at the frequency indicated:

A.

B.

C.

Route: _____ Project: BR/BR-Z-NBIS (XXX)

Made By: _____ Date: _____ Checked By: _____ Date: _____

SUMMARY OF RATING

The ratings, computed in the _____ and updated in the _____ cycle report in accordance with the Current AREA Manual as modified by the New Jersey Department of Transportation in the current Design Manual for Bridges and Structures:

Allowable Stresses - MPa (psi)

<u>Material</u>	<u>Yield</u>	<u>Inventory</u>	<u>Operating</u>
Concrete	XX (f_c)	XX	XX
Reinforcing Steel	XX	XX	XX
Structural Steel	XX	XX	XX

(The summary of all ratings shall be listed in accordance with the following charts).

FOR STEEL AND CONCRETE MEMBERS

COOPER E RATING ANALYSIS
INVENTORY RATINGS

Structure Number _____

Controlling Cooper E Rating _____

Member	Capacity of Bridge				Equivalent Cooper E Loading of Equipment										Remarks
	Cooper E Load				(For Proper Span Length)										
	As Built		As Inspected		Load # 1		Load # 2		Load # 3		Load # 4		Load # 5		
	E	E	E	E	E	E	E	E	E	E	E	E	E	E	
	Moment	Shear	Moment	Shear	Moment	Shear	Moment	Shear	Moment	Shear	Moment	Shear	Moment	Shear	

Note: E = Cooper Load

FOR STEEL AND CONCRETE MEMBERS

COOPER E RATING ANALYSIS
OPERATING RATINGS

Structure Number _____ Controlling Cooper E Rating _____

M e m b e r	Capacity of Bridge				Equivalent Cooper E Loading of Equipment										R e m a r k s
	Cooper E Load				(For Proper Span Length)										
	A s B u i l t		A s I n s p e c t e d		L o a d # 1		L o a d # 2		L o a d # 3		L o a d # 4		L o a d # 5		
	E	E	E	E	E	E	E	E	E	E	E	E	E	E	
	M o m e n t	S h e a r	M o m e n t	S h e a r	M o m e n t	S h e a r	M o m e n t	S h e a r	M o m e n t	S h e a r	M o m e n t	S h e a r	M o m e n t	S h e a r	

Note: E = Cooper Load

FOR TIMBER MEMBERS

COOPER E RATING ANALYSIS
INVENTORY RATINGS
ASSIGNED LOCOMOTIVES

Structure Number _____

Controlling Cooper E Rating _____

Member	Capacity of Bridge				Equivalent Cooper E Loading of Equipment										Remarks
	Cooper E Load				(For Proper Span Length)										
	As Built		As Inspected		Load # 1		Load # 2		Load # 3		Load # 4		Load # 5		
	E	E	E	E	E	E	E	E	E	E	E	E	E	E	
	Moment	Shear	Moment	Shear	Moment	Shear	Moment	Shear	Moment	Shear	Moment	Shear	Moment	Shear	

Note: E = Cooper Load

FOR TIMBER MEMBERS

COOPERATING ANALYSIS

OPERATING RATINGS

NOT ASSIGNED LOCOMOTIVES

Structure Number _____

Controlling Cooper E Rating _____

Member	Capacity of Bridge				Equivalent Cooper E Loading of Equipment										Remarks
	Cooper E Load				(For Proper Span Length)										
	As Built		As Inspected		Load # 1		Load # 2		Load # 3		Load # 4		Load # 5		
	E	E	E	E	E	E	E	E	E	E	E	E	E	E	
	Moment	Shear	Moment	Shear	Moment	Shear	Moment	Shear	Moment	Shear	Moment	Shear	Moment	Shear	
														</	

Note: E = Cooper Load

1.42.2 RE-EVALUATION SURVEY REPORT FORMAT - BR - (FOR RAILROAD CARRYING BRIDGES)

The report of the results of a re-evaluation Bridge survey and rating of an existing railroad bridge, performed by or for the Department, shall adhere to the following format:

- (A). **REPORT COVER SHEET:** The report's cover sheet shall utilize the same form as indicated in Format AR (see attached sample in Format BR).

The cover sheet colors shall be the same as specified under Format AR.

The report shall be bound using a standard 3-hole punch type binding.

- (B). **LETTER OF TRANSMITTAL (CONSULTANT PROJECTS ONLY):** The letter of transmittal shall be addressed as shown in Format AR (see sample in Format AR):

- (C). **TABLE OF CONTENTS:** One page indicating items 1 thru 9 in order shown as follows and providing the page number in the report on which each item starts. All pages in the report shall be numbered (i.e. Cycle No.- Page No.) at the bottom and centered.

Page No.

1. Maps.....	
2. Structural Data	
3. Controlling Ratings	
4. Conclusions and Recommendations	
5. Appendix 1 - Structure Inventory & Appraisal Sheets	
6. Appendix 2 - Computations	
7. Appendix 3 - Drawings, Soundings and Photographs.....	
8. Appendix 4 - Field Notes with CADD Sketches	
9. Appendix 5 - Underwater Inspection Report/ Other Special Report if applicable	

1. **Maps:** Two maps, are required as specified in Format AR. If the previous bridge survey report contains up-to-date General Location and Local Maps done to the required specifications, no maps are required.
2. **Structural Data:** A summary of findings and work done shall be included as indicated in Format AR.
3. **Controlling Ratings:** The ratings shall be provided as indicated in Format AR (give reference to the bridge survey report cycle where the detailed rating computations were made if not calculated in the current cycle report).

4. **Conclusions & Recommendations:** Conclusions shall be provided as indicated in Format AR. Also, comment on any major changes in the condition of all components since the previous bridge survey report. If no changes have occurred, include a statement to that effect.
5. **Appendix 1 - Structure Inventory & Appraisal Sheet:** This section should contain the above listed data form as indicated in Format AR.
6. **Appendix 2 - Computations:** In this section, include computations of ratings for various major bridge components as indicated in Format AR (see samples in Format AR).
7. **Appendix 3 - Drawings, Soundings & Photographs:** This section shall contain bridge drawings, sounding sketches, photo location plan sketch and photographs as indicated in Format AR.
8. **Appendix 4 - Field Notes:** Provide field notes or CADD sketches as specified in Format AR in this section.
9. **Appendix 5 - Underwater Inspection:** In this section, include the diver's inspection report (if applicable) or other additional appendices as specified in Format AR.

Sample - For State Bridges
(Consultant Report Cover Sheet)

NEW JERSEY DEPARTMENT OF TRANSPORTATION

BRIDGE RE-EVALUATION SURVEY REPORT OF THE

Structure No. 1609-152
Boonton Line over Rt. 80
RR MP 20.18
Route 5080
USRA Line Code 6101
Wayne Township
Passaic County

CYCLE NO. 2
AUGUST, 1996

XYZ ENGINEERS, INC.
100 Lincoln Place
East Orange, New Jersey 07018

(FORMAT "BR")
NEW JERSEY DEPARTMENT OF TRANSPORTATION
STRUCTURAL EVALUATION/BRIDGE MANAGEMENT UNIT
RE-EVALUATION BRIDGE SURVEY REPORT
FOR RAILROAD CARRYING BRIDGES

CYCLE NO._____

STRUCTURAL DATA

Bridge No. _____ Year Built: _____
Reconstr/Widening: _____

Route No. _____ RR km (Mile) Post _____ Length: _____ Width: _____

Name: _____ Date of This Eval.: _____

Line/Branch: _____
By: _____

Date of FCM/Pin Hanger Inspection: _____

By: _____

(Only when special inspections are applicable)

USRA Line Code: _____ Date of Prev.
Eval.: _____

Structure Type: _____
By: _____

_____ Special Equipment Used: _____
(Include Photo)

_____ Date of Underwater Insp: _____

_____ Date of Special Testing: _____

_____ Date of Electr./Mech. Insp.: _____
(Movable Bridges Only)

Overall Condition: _____

Work Done: _____

Component/ Material	Cond. Rating	General Remarks
<hr/>		
DECK/		
<hr/>		
APPROACHES (Condition of Rail & Track Bed)		
<hr/>		
SUPERSTRUCTURE		
<hr/>		
SUBSTRUCTURE		
<hr/>		
CHANNEL/ WATERWAY		
<hr/>		
RAILROAD SAFETY FEATURES		
<hr/>		
<hr/>		

The minimum vertical underclearance is _____ under _____

The lateral clearances are: Left: _____ Right: _____

For waterways include horizontal and vertical clearances of the main channel span.

CONTROLLING RATINGS (From _____ Cycle Report):

<u>Controlling Member</u>	<u>As Built</u>	<u>As Inspected</u>	<u>Remarks</u>
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End Floorbeam	Inventory Ratings
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Interior Stringer	Operating Ratings
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Controlling
Live Load

Equivalent Cooper E

CONCLUSIONS AND RECOMMENDATIONS:

For an explanation of the requirements for this section, refer to Format AR.

Since the previous inspection, _____
(Give brief description of the significant changes in the condition of the various components. Do not include work done in this section).

((Give a brief description and location of the fracture critical members or pin hanger details (specify when FCM's are internally redundant i.e., riveted)).

Note: The following area(s) or structural member(s) should be inspected on an interim basis at the frequency indicated:

A.

B.

C.

1.42.3 RE-EVALUATION SURVEY REPORT FORMAT - CR - (FOR RAILROAD CARRYING BRIDGES)

The report of the results of a re-evaluation bridge survey and rating of an existing railroad bridge, performed by or for the Department, shall adhere to the following format:

- (A). **REPORT COVER SHEET:** The report's cover sheet shall include utilize the same form as indicated in Format AR (see attached sample in Format BR).

The cover sheet colors shall be the same as specified under Format AR.

The report shall be bound using a standard 3-hole punch type binding.

- B). **LETTER OF TRANSMITTAL (CONSULTANT PROJECTS ONLY):** The letter of transmittal shall be addressed as shown in Format AR (see sample in Format AR).

- (C). **TABLE OF CONTENTS:** Provide a table of contents sheet as specified under Format BR.

1. **Maps:** Two maps, are required as specified in Format AR. If the previous bridge survey report contains up-to-date General Location and Local Maps done to the required specifications, no maps are required.
2. **Structural Data:** A summary of findings and work done since the previous bridge survey shall be included as indicated in Format AR.
3. **Controlling Ratings:** The ratings shall be provided as indicated in Format AR (give reference to the bridge survey report cycle where the detailed rating computations were made if not calculated in the current cycle report).
4. **Conclusions & Recommendations:** State the overall condition of the structure (consistent with SI&A Item 67) and include a paragraph summarizing the conditions of the various components to be coded as they are. For large or complex structures, it may be necessary to include one paragraph for each component rather than one long paragraph. If an underwater diver inspection has been conducted and no repairable defects were discovered, the underwater inspection should be noted here. If repairable defects were discovered by the diver, appropriate remedial repairs should be included in the report.

Conclusions shall be provided as indicated in Format AR. Also, comment on any major changes in the condition of all components since the previous bridge survey report cycle. If no changes have occurred, include a statement to that effect.

5. **Appendix 1 - Structure Inventory & Appraisal Sheet:** This section should contain the above listed data form as indicated in Format AR.
6. **Appendix 2 - Computations:** In this section, include computations of ratings for various major bridge components as indicated in Format AR (see samples in Format AR).

7. **Appendix 3 - Drawings, Soundings & Photographs:** This section shall contain bridge drawings, sounding sketches, photo location plan sketch and photographs as indicated in Format AR.
8. **Appendix 4 - Field Notes:** Provide field notes or CADD sketches as specified in Format AR in this section.
9. **Appendix 5 - Underwater Inspection:** In this section, include the diver's inspection report (if applicable) or other additional appendices as specified in Format AR.

(FORMAT "CR")

**NEW JERSEY DEPARTMENT OF TRANSPORTATION
STRUCTURAL EVALUATION/BRIDGE MANAGEMENT UNIT
RE-EVALUATION BRIDGE SURVEY REPORT
FOR RAILROAD CARRYING BRIDGES**

CYCLE NO._____

STRUCTURAL DATA

Bridge No. _____ Year Built: _____
Reconstr/Widening: _____

Route No. _____ RR km (Mile) Post _____ Length: _____
Width: _____

Name: _____ Date of This
Eval.: _____

Line/Branch: _____
By: _____

Date of FCM/Pin Hanger Inspection: _____

By: _____

(Only when special inspections are applicable)

USRA Line Code: _____ Date of Prev.
Eval.: _____

Structure Type: _____
By: _____

_____ Special Equipment
Used: _____
(Include Photo)

_____ Date of Underwater
Insp: _____

_____ Date of Special
Testing: _____

_____ Date of Electr./Mech.
Insp.: _____
(Movable Bridges Only)

Overall Condition:_____

Work Done:_____

CONTROLLING RATINGS (see Format BR for the requirements of this section)

CONCLUSIONS AND RECOMMENDATIONS:

The overall condition of the structure is _____ due to _____.
The deck is in _____ condition due to _____. The approaches are
in _____ condition due to _____. The superstructure is in
_____ condition due to _____. The substructure is in
_____ condition due to _____. (List the significant defects
which are the main reasons for the condition ratings of the above structural elements. If an
element has no significant defects; i.e., coded 6 or higher, it should be deleted from the above).

Since _____ the _____ previous
inspection, _____
(Give brief description of significant changes in the condition of the various components.
Do not include work done in this section.)

((Give a brief description and location of the fracture critical members or pin hanger details
(specify when FCM's are internally redundant - i.e., riveted)).

For an explanation of the requirements for this section, refer to Format AR.

Note: The following area(s) or structural member(s) should be inspected on an interim basis at
the frequency indicated:

- A.
- B.
- C.

1.42.4 INTERIM SURVEY REPORT FORMAT - DR - (FOR RAILROAD CARRYING BRIDGES)

The report of the results of an interim bridge survey and rating of an existing railroad bridge, performed by or for the Department, shall adhere to the following format:

- (A). **REPORT COVER SHEET:** The report's cover sheet shall utilize the same form as indicated in Format AR (see attached sample in Format DR).

The report shall be bound using a standard 3-hole punch type binding.

- (B). **LETTER OF TRANSMITTAL (CONSULTANT PROJECTS ONLY):** The letter of transmittal shall be addressed as shown in Format AR (see sample in Format AR):

- (C). **TABLE OF CONTENTS:** One page indicating items 1 thru 8 in order shown as follows and providing the page number in the report on which each item starts. All pages in the report shall be numbered at the bottom and centered.

Page No.

1. Structural Data	
2. Controlling Ratings	
3. Reason for Interim Survey	
4. Current Condition	
5. Conclusions and Recommendations	
6. Appendix 1 - Structure Inventory & Appraisal Sheets	
7. Appendix 2 - Computations	
8. Appendix 3 - Drawings, Soundings and Photographs	

1. **Structural Data:** A summary of findings and work done shall be included as per the attached format. The items in this format are self-explanatory.
2. **Controlling Ratings:** The ratings should include the controlling member and controlling Inventory and Operating Ratings of the bridge and include a speed restriction chart (if applicable), as per Subsection 1.42.5, "Rating of Existing Railroad Structures".
3. **Reasons for Interim Survey:** Indicate specifically the areas or members of the bridge requiring an interim inspection. These areas could be locations of deterioration such as loss of concrete under a bearing or a tilted wingwall. They also could be structure members with low operating ratings (List all members with low operating ratings) or fracture critical members.
4. **Current Condition:** Indicate the current condition of the items identified in the previous section. Also, state if any changes have occurred since the last survey (in-depth or interim).
5. **Conclusions & Recommendations:** Conclusions resulting from the interim bridge evaluation survey regarding the items inspected should be given here. Also, include possible explanation of the causes of any inadequacies found.

Make specific new recommendations for safety improvements, major repair work (i.e. structure rehabilitation and/or replacement), and other repair work to correct significant defects, deteriorations and inadequacies found during this interim bridge survey. The intent is to list any new repairs which are needed, not to repeat the recommendations from the latest bridge evaluation survey report. If no new repairs are necessary, this should be stated.

The recommendations should be specific about the location of defects and the methods of repair. The recommendations for other repair work should be listed in the order of priority. Each recommendation should be referenced to the photos. For major repair work, provide cost estimates. For other repair work, provide quantities only.

6. **Appendix 1 - Structure Inventory & Appraisal Sheet:** This section should contain the above listed data form as indicated in Format AR.
7. **Appendix 2 - Computations:** In this section, include computations of ratings for various major bridge components as indicated in Format AR.
8. **Appendix 3 - Drawings, Soundings & Photographs:** This section shall contain bridge drawings, sounding sketches, photo location plan sketch and photographs as indicated in Format AR. If approved by the project manager, only one copy of the interim survey report may be required to have original photographs with the remaining copies black-and-white photocopies.

**Sample - For State Bridges
(Consultant Report Cover Sheet)**

**NEW JERSEY DEPARTMENT OF
TRANSPORTATION**

**INTERIM BRIDGE SURVEY REPORT
OF THE**

**Structure No. 1609-152
Boonton Line over Rt. 80
RR MP 20.18
Route 5080
USRA Line Code 6101
Wayne Township
Passaic County**

AUGUST, 1996

**XYZ ENGINEERS, INC.
100 Lincoln Place
East Orange, New Jersey 07018**

(FORMAT "DR")

NEW JERSEY DEPARTMENT OF TRANSPORTATION
STRUCTURAL EVALUATION/BRIDGE MANAGEMENT UNIT
INTERIM BRIDGE SURVEY REPORT FOR RAILROAD CARRYING
BRIDGES

FREQUENCY: _____ MONTHS

STRUCTURAL DATA

Bridge No. _____ Year _____
Built: _____

Route No. _____ RR km (Mile) Post _____

Length: _____ Width: _____

Name: _____ Date of This _____
Eval: _____

Line/Branch: _____ By: _____

USRA Line Code: _____ *Date of Previous Interim
Survey: _____

Structure Type: _____ *By: _____

_____ Date of Last
_____ Routine Eval:
_____ By:

Special Equipment: _____
(Include Photos)

Overall Condition: _____

Work Done:

Reason for Interim Survey:

Current Condition or changes in items inspected:

* Use only if there was another interim survey after the last routine survey.

CONCLUSIONS AND RECOMMENDATIONS:

We recommend that the following repairs or rehabilitation be made to retard further deterioration, preserve the structural integrity of the bridge, improve safety and extend its useful life:

In addition to any recommendations noted here, all of the recommendations from the previous reports (routine or interim) are still in effect if not already completed.

Next interim inspection is recommended at _____ intervals.

1.42.5 RATING OF EXISTING RAILROAD STRUCTURES

The following instructions shall be incorporated with the current A.R.E.A. Manual for the above subject.

A. Steel and Concrete Structures

1. In rating railroad structures use 0.55fy for inventory (design stress) in all types of steel and wrought iron. Use 0.8fy for operating (rating stress) for A36, A7, open hearth steel, and wrought iron according to A.R.E.A. 7.3.4.3, Chapter 15; for other steel refer to A.R.E.A. 7.3.4.3, Chapter 15, for permissible operating (rating) stresses only.
2. Bridge ratings (inventory and operating) will be in terms of Cooper E loadings.
3. In rating existing concrete structures use the allowable service load stresses for inventory (design stresses) according to A.R.E.A. Chapter 8, Section 2.26, Page 8-2-29. Use the permissible unit stresses for operating (rating stresses) according to A.R.E.A. Chapter 8, Page 8-19-4).
4. Structure members shall be rated for as-built and as-inspected condition using one of the Cooper E series in accordance with A.R.E.A.
5. For each controlling member equivalent Cooper E loads shall be computed for each live load shown in the attachment.
6. When any of the NJ Transit loads (1 thru 5) are applied at normal operating speed, and Conrail's anticipated freight load, load 6 applied at 65 km/h (40 mph), is greater in terms of Cooper E loading than a specific member's Cooper E Inventory rating, the speed restrictions must be introduced (see A.R.E.A. Chapter 15, 7.3.3.3., for steel; and Chapter 8, Part 19, for concrete).
 - a. When the equivalent Cooper E for specific loading is greater than the Cooper E inventory rating of the structure (with impact computed at 16 km/h (10mph)), then 93% of the Cooper E operating rating of the structure will control (with impact computed at 16 km/h (10 mph)) and no other trains except for the specific loading shall be allowed on the structure at the same time with a maximum speed of 16 km/h (10 mph).
 - b. If the equivalent Cooper E for a specific loading at 16 km/h (10 mph) exceeds 93% of the operating rating of the structure, then the loading shall be restricted from the structure until the structure can be rehabilitated to a satisfactory capacity rating.
7. All recommendations for rehabilitating the structure shall be based on upgrading all member's inventory ratings to a level sufficient to sustain the maximum anticipated loading condition (Equivalent Cooper E).
8. When the equivalent Cooper E load for a specific loading is greater than the controlling members equivalent Cooper E load rated for "REGULARLY ASSIGNED LOCOMOTIVES", the loading shall be restricted to 16 km/h (10 mph).
9. When speed restrictions are required, a speed chart shall be made for the

controlling member's Cooper E inventory rating. The speed chart shall range as follows:

Steel: from the equivalent Cooper E load at 100 km/h (60 mph) for load 1 thru 5, and 65 km/h (40 mph) for load 5, to the equivalent Cooper E load at 16 km/h (10 mph).

Concrete: from the equivalent Cooper E load at 65 km/h (40 mph) for all loads, to an equivalent Cooper E load 16km/h (10 mph).

B. Timber Structures

1. Rating of wood structures shall be done in accordance with A.R.E.A. Chapter 7, Page 7-2-23.
2. Structure members shall be rated using one of the Cooper E Series.
3. In accordance with Chapter 7, Page 7-2-24, when the support under a rail consists of three or more stringers assembled as a chord or acting in unison and extending over two spans with staggered joints, a partially continuous beam action may be assumed to exist and the computations may be made for stringers based on the average stress as determined from single beam analysis and that for a fully continuous condition.
4. When analyzing notched beams the average live load and reaction as found from above shall be used and the allowable end reaction shall be computed using the formula in Chapter 7, Section E, Art. 4, Page 7-2-16.
5. The permissible unit stresses for rating shall be in accordance with Chapter 7, Art. 13, Page 7-2-25.
6. Structure members shall be rated for "LOCOMOTIVES NOT REGULARLY ASSIGNED" and for "REGULARLY ASSIGNED LOCOMOTIVES", and shall be in terms of equivalent Cooper E loads.
7. For each controlling member, equivalent Cooper E loads shall be made for each live load shown in the attachment.
8. When the equivalent Cooper E load for a specific loading is greater than the controlling members equivalent Cooper E load rated for "REGULARLY ASSIGNED LOCOMOTIVES", the loading shall be restricted to 16 km/h (10 mph).
9. When the equivalent Cooper E load for a specific loading is greater than the controlling members equivalent Cooper E load rated for "NOT REGULARLY ASSIGNED LOCOMOTIVES", the "K" coefficient shall not be increased to 15% as stated in A.R.E.A. Chapter 7, Art. 13, page 7-2-25 and the loading shall be restricted from the structure until the structure can be rehabilitated to a satisfactory capacity rating.

The following Tables are provided in English and Metric units.

MOMENT AND SHEAR TABLE

LOAD 1

4 ES6 DIESELS COUPLED TO AAR CARS

SPAN		BENDING			END SHEAR			FLOOR BEAM REACTION		
meter	feet	kN.m	ft-kips	E	kN	kips	E	kN	kips	E
2.44	8	141.01	104.00	52.0	246.97	55.52	40.4	246.97	55.52	31.7
3.05	10	176.26	130.00	46.2	277.57	62.40	41.6	310.49	69.80	34.9
3.66	12	211.51	156.00	39.0	308.40	69.33	39.6	352.79	79.31	34.0
3.96	13	231.75	170.93	36.0	320.27	72.00	39.0	369.07	82.97	33.7
4.27	14	259.23	191.20	34.8	330.46	74.29	38.5	389.75	87.62	33.6
4.57	15	286.88	211.59	33.9	339.27	76.27	38.1	413.95	93.06	34.0
4.88	16	317.26	234.00	33.4	346.96	78.00	36.7	435.13	97.82	34.4
5.49	18	388.78	286.75	33.7	365.87	82.25	35.2	470.40	105.75	34.9
6.10	20	474.64	350.08	33.9	395.14	88.83	35.5	498.65	112.10	34.2
7.62	25	696.24	513.52	33.7	466.62	104.90	36.9	588.54	132.31	35.0
9.14	30	976.88	720.51	35.1	514.30	115.62	36.7	691.83	155.53	36.1
10.67	35	1 233.05	909.45	34.8	554.25	124.60	36.0	778.93	175.11	35.9
12.19	40	1 519.80	1,120.95	34.2	589.83	132.60	35.2	878.75	197.55	36.5
13.72	45	1 834.64	1,353.16	33.8	641.52	144.22	35.3	984.17	221.25	37.2
15.24	50	2 242.40	1,653.91	35.8	701.48	157.70	36.1	1 091.59	245.40	38.0
18.29	60	3 163.14	2,333.01	35.8	801.70	180.23	36.6	1 291.32	290.30	37.8
21.34	70	4 154.92	3,064.51	35.9	912.95	205.24	37.1	1 504.92	338.32	38.1
24.38	80	5 356.90	3,951.05	36.5	1 019.35	229.16	36.9	1 711.10	384.67	38.5
27.43	90	6 749.49	4,978.17	37.2	1 123.00	252.46	36.8	1 924.39	432.62	39.4
30.48	100	8 317.79	6,134.89	38.0	1 233.36	277.27	37.0	2 134.43	479.84	40.2
36.58	120	11 808.00	8,709.13	37.8	1 446.87	325.27	37.4	2 496.48	561.23	41.0
42.67	140	16 054.51	11,841.20	38.1	1 658.83	372.92	37.9	2 835.61	637.47	41.2
48.77	160	20 861.51	15,386.66	38.5	1 870.92	420.60	38.4	3 167.85	712.16	41.2
54.86	180	26 394.98	19,467.94	39.4	2 082.12	468.08	38.9	3 493.10	785.28	41.0
60.96	200	32 528.49	23,991.78	40.2	2 281.67	512.94	39.2	3 802.96	854.94	40.7
68.58	225	40 340.39	29,753.54	40.6	2 505.64	563.29	39.1	4 179.24	939.53	40.1
76.20	250	49 336.24	36,388.54	41.2	2 740.42	616.07	39.2	4 551.82	1,023.29	39.6
83.82	275	58 537.14	43,174.78	41.2	2 979.24	669.76	39.4	4 884.99	1,098.19	38.9
91.44	300	68 737.37	50,698.08	41.3	3 203.79	720.24	39.4	5 162.65	1,160.61	37.8
106.68	350	90 994.78	67,114.30	41.1	3 656.26	821.96	39.4	5 598.93	1,258.69	35.4
121.92	400	115 913.76	85,493.60	40.7	4 103.13	922.42	39.4	5 926.19	1,332.26	32.9

kN	kips	m	ft.
231.3	(52.0)	2.44	(8' 0")
231.3	(52.0)	4.27	(14' 0")
231.3	(52.0)	2.44	(8' 0")
231.3	(52.0)	4.15	(13' 7 1/2")
231.3	(52.0)	2.44	(8' 0")
231.3	(52.0)	4.27	(14' 0")
231.3	(52.0)	2.44	(8' 0")
231.3	(52.0)	4.15	(13' 7 1/2")
231.3	(52.0)	2.44	(8' 0")
231.3	(52.0)	4.27	(14' 0")
231.3	(52.0)	2.44	(8' 0")
231.3	(52.0)	4.15	(13' 7 1/2")
231.3	(52.0)	2.44	(8' 0")
231.3	(52.0)	4.27	(14' 0")
231.3	(52.0)	2.44	(8' 0")
231.3	(52.0)	3.30	(10' 9 3/4")
188.2	(42.3)	1.68	(5' 6")
188.2	(42.3)	7.72	(25' 4")
188.2	(42.3)	1.68	(5' 6")
188.2	(42.3)	2.44	(8' 0")
188.2	(42.3)	1.68	(5' 6")

|13.30(43' 7 1/2")|13.30 (43' 7 1/2") | 13.30 (43' 7 1/2") |13.30 (43' 7 1/2") | 13.51 (44' 4") |

1 - ES6 1 - ES6 1 - ES6 1 - ES6 AAR Cars 753 kN(169.2 Kips)

MOMENT AND SHEAR TABLE

LOAD 2

4 ES10 DIESELS COUPLED TO 979 kN (220 KIPS) CARS

SPAN		BENDING			END SHEAR			FLOOR BEAM REACTION		
meter	ft.	kN.m	ft-kips	E	kN	kips	E	kN	kips	E
2.44	8	168.39	124.20	62.1	321.12	72.19	52.5	366.98	82.50	47.1
3.05	10	210.49	155.25	55.2	354.75	79.75	53.2	440.37	99.00	49.5
3.66	12	265.98	196.18	49.0	377.16	84.79	48.5	489.30	110.00	47.1
3.96	13	301.33	222.25	46.8	404.61	90.96	49.3	526.94	118.46	48.1
4.27	14	337.06	248.60	45.2	428.14	96.25	49.9	559.19	125.71	48.2
4.57	15	391.91	289.06	46.2	448.51	100.83	50.4	587.17	132.00	48.3
4.88	16	447.81	330.29	47.2	466.35	104.84	49.3	611.63	137.50	48.4
5.49	18	559.61	412.75	48.6	502.92	113.06	48.5	652.42	146.67	48.4
6.10	20	671.44	495.23	48.0	550.47	123.75	49.5	685.03	154.00	47.0
7.62	25	1 000.92	738.24	48.4	636.10	143.00	50.4	743.74	167.20	44.2
9.14	30	1 368.51	1,009.36	49.2	693.17	155.83	49.4	843.16	189.55	43.9
10.67	35	1 715.11	1,265.00	48.4	733.96	165.00	47.7	950.45	213.67	43.8
12.19	40	2 087.96	1,540.00	47.0	764.56	171.88	45.6	1 055.65	237.32	43.8
13.72	45	2 460.81	1,815.00	45.3	810.02	182.10	44.6	1 172.95	263.69	44.3
15.24	50	2 833.66	2,090.00	44.2	883.15	198.54	45.4	1 297.95	291.79	45.1
18.29	60	3 854.93	2,843.25	43.7	1 001.65	225.18	45.7	1 534.10	344.88	44.9
21.34	70	5 069.74	3,739.25	43.8	1 130.69	254.19	46.0	1 779.64	400.08	45.0
24.38	80	6 435.27	4,746.41	43.8	1 257.69	282.74	45.5	2 023.76	454.96	45.5
27.43	90	8 044.18	5,933.08	44.3	1 379.84	310.20	45.2	2 266.64	509.56	46.4
30.48	100	9 890.46	7,294.83	45.1	1 510.75	339.63	45.3	2 517.03	565.85	47.5
36.58	120	14 027.97	10,346.50	44.9	1 760.38	395.75	45.5	2 989.47	672.06	49.1
42.67	140	18 985.06	14,002.66	45.0	2 009.71	451.80	45.9	3 447.59	775.05	50.1
48.77	160	24 673.47	18,198.22	45.5	2 257.43	507.49	46.3	3 898.07	876.32	50.7
54.86	180	31 089.02	22,930.08	46.4	2 505.33	563.22	46.8	4 348.40	977.56	51.1
60.96	200	38 359.47	28,292.49	47.5	2 745.71	617.26	47.1	4 792.65	1,077.43	51.3
68.58	225	47 977.72	35,386.55	48.3	3 010.29	676.74	46.9	5 354.19	1,203.67	51.4
76.20	250	59 157.85	43,632.59	49.4	3 298.00	741.42	47.2	5 847.94	1,314.67	50.9
83.82	275	70 941.77	52,323.96	49.9	3 581.71	805.20	47.3	6 251.89	1,405.48	49.8
91.44	300	84 022.02	61,971.46	50.5	3 868.44	869.66	47.5	6 588.48	1,481.15	48.3
106.68	350	113 004.45	83,347.80	51.0	4 465.08	1,003.79	48.1	7 117.47	1,600.07	45.0
121.92	400	146 080.48	107,743.43	51.3	5 057.67	1,137.01	48.6	7 514.25	1,689.27	41.7

kips	(52.0)	(52.0)	(52.0)	(52.0)	(52.0)	(52.0)	(52.0)	(52.0)	(52.0)	(52.0)	(52.0)	(52.0)	(52.0)	(52.0)	(52.0)	(52.0)	(42.3)	(42.3)	(42.3)	(42.3)	(42.3)	(42.3)
kN	276.2	276.2	276.2	276.2	276.2	276.2	276.2	276.2	276.2	276.2	276.2	276.2	276.2	276.2	276.2	276.2	244.7	244.7	244.7	244.7	244.7	244.7
	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
m	2.44	4.27	2.44	4.27	2.44	4.27	2.44	4.27	2.44	4.27	2.44	4.27	2.44	4.27	2.44	3.19	1.68	7.47	1.68	1.68	1.68	1.68
ft	(8' 0")	(14' 0")	(8' 0")	(14' 0")	(8' 0")	(14' 0")	(8' 0")	(14' 0")	(8' 0")	(14' 0")	(8' 0")	(14' 0")	(8' 0")	(14' 0")	(8' 0")	(10' 5 1/2")	(5' 6")	(24' 6")	(5' 6")	(5' 6")	(5' 6")	(5' 6")

| 13.54(44' 5") | 13.54(44' 5") | 13.54(44' 5") | 13.54(44' 5") | 12.80(42' 0") |
1 - ES10 1 - ES10 1 - ES10 1 - ES10 979 kN (220 kips)Car

MOMENT AND SHEAR TABLE

LOAD 3

4-BF 15 DIESELS COUPLED TO 979 kN (220 KIPS) CARS

SPAN		BENDING			END SHEAR			FLOOR BEAM REACTION		
meter	ft.	kN.m	ft-kips	E	kN	kips	E	kN	kips	E
2.44	8	184.39	136.00	68.0	321.12	72.19	52.5	366.98	82.50	47.1
3.05	10	230.49	170.00	60.4	354.75	79.75	53.2	440.37	99.00	49.5
3.66	12	276.59	204.00	51.0	377.16	84.79	48.5	489.30	110.00	47.1
3.96	13	301.33	222.25	46.8	404.61	90.96	49.3	526.94	118.46	48.1
4.27	14	337.06	248.60	45.2	428.14	96.25	49.9	559.19	125.71	48.2
4.57	15	391.91	289.06	46.2	448.51	100.83	50.4	587.17	132.00	48.3
4.88	16	447.81	330.29	47.2	466.35	104.84	49.3	611.63	137.50	48.4
5.49	18	559.61	412.75	48.6	502.92	113.06	48.5	652.42	146.67	48.4
6.10	20	671.44	495.23	48.0	550.47	123.75	49.5	685.03	154.00	47.0
7.62	25	1 000.92	738.24	48.4	636.10	143.00	50.4	743.74	167.20	44.2
9.14	30	1 368.51	1,009.36	49.2	693.17	155.83	49.4	782.89	176.00	40.8
10.67	35	1 715.11	1,265.00	48.4	733.96	165.00	47.7	845.78	190.14	39.0
12.19	40	2 087.96	1,540.00	47.0	764.56	171.88	45.6	945.20	212.49	39.3
13.72	45	2 460.81	1,815.00	45.3	804.64	180.89	44.3	1 060.14	238.33	40.0
15.24	50	2 833.66	2,090.00	44.2	858.73	193.05	44.2	1 193.90	268.40	41.5
18.29	60	3 579.36	2,640.00	40.6	986.75	221.83	45.0	1 467.91	330.00	42.9
21.34	70	4 511.48	3,327.50	39.0	1 125.40	253.00	45.8	1 677.60	377.14	42.4
24.38	80	5 761.98	4,249.82	39.3	1 229.40	276.38	44.5	1 871.59	420.75	42.1
27.43	90	7 270.57	5,362.50	40.0	1 327.93	298.53	43.5	2 105.39	473.31	43.1
30.48	100	9 097.54	6,710.00	41.5	1 449.59	325.88	43.5	2 368.23	532.40	44.7
36.58	120	13 422.60	9,900.00	42.9	1 694.19	380.87	43.8	2 802.29	629.98	46.0
42.67	140	17 896.80	13,200.00	42.4	1 914.38	430.37	43.8	3 252.67	731.23	47.3
48.77	160	22 818.42	16,830.00	42.1	2 159.03	485.37	44.3	3 699.27	831.63	48.1
54.86	180	28 877.23	21,298.75	43.1	2 379.22	534.87	44.4	4 135.02	929.59	48.6
60.96	200	36 091.88	26,620.00	44.7	2 623.92	589.88	45.0	4 557.78	1,024.63	48.7
68.58	225	45 413.12	33,495.00	45.7	2 902.64	652.54	45.3	5 111.72	1,149.16	49.1
76.20	250	55 517.36	40,947.50	46.3	3 190.53	717.26	45.6	5 627.00	1,265.00	49.0
83.82	275	66 915.41	49,354.27	47.1	3 473.39	780.85	45.9	6 072.22	1,365.09	48.3
91.44	300	72 672.06	53,600.16	47.8	3 758.26	844.89	46.2	6 443.25	1,448.50	47.2
106.68	350	107 426.33	79,233.59	48.5	4 319.27	971.01	46.6	7 026.28	1,579.57	44.4
121.92	400	138 921.13	102,462.96	48.7	4 876.76	1,096.34	46.9	7 463.54	1,677.87	41.4

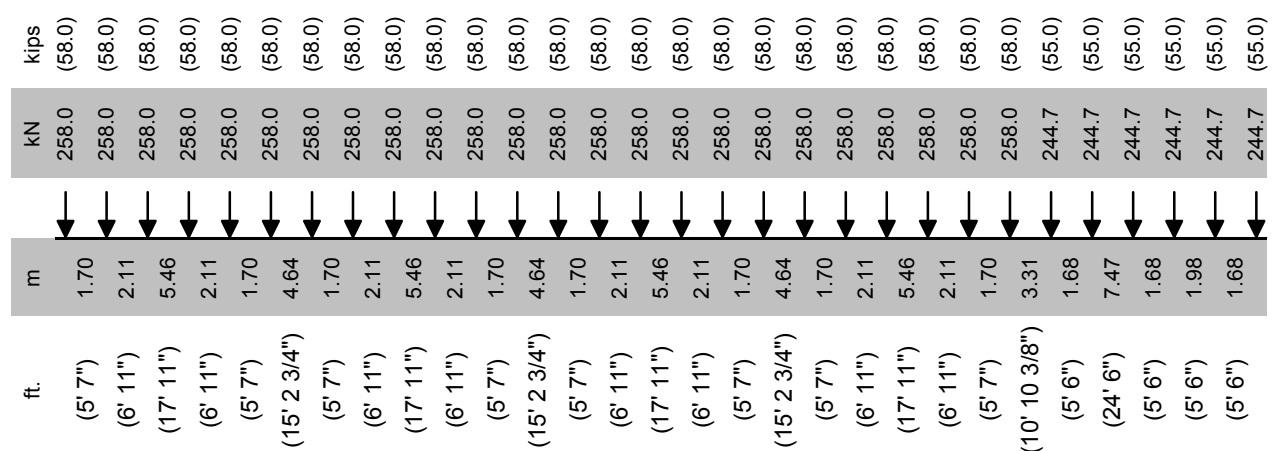
kN	289.1	289.1	302.5	302.5	293.6	293.6	278.0	278.0	293.6	293.6	278.0	278.0	302.5	302.5	289.1	289.1	244.7	244.7	244.7	244.7	244.7	244.7
kips	(52.0)	(52.0)	(52.0)	(52.0)	(52.0)	(52.0)	(52.0)	(52.0)	(52.0)	(52.0)	(52.0)	(52.0)	(52.0)	(52.0)	(52.0)	(52.0)	(42.3)	(42.3)	(42.3)	(42.3)	(42.3)	(42.3)
	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
m	3.00	5.59	3.00	4.45	3.00	5.59	3.00	4.45	3.00	5.59	3.00	4.45	3.00	5.59	3.00	3.76	1.68	7.47	1.68	1.68	1.68	
ft.	9' 10"	18' 4"	9' 10"	14' 7"	9' 10"	18' 4"	9' 10"	14' 7"	9' 10"	18' 4"	9' 10"	14' 7"	9' 10"	18' 4"	9' 10"	12' 4"	(5' 6")	24' 6"	(5' 6")	(5' 6")	(5' 6")	

[16.57(54' 4 1/2") | 16.03(52' 7") | 16.03(52' 7") | 16.57(54' 4 1/2") | 12.80(42' 0") |
 1 - BF 15 1 - BF 15 1 - BF 15 1 - BF 15 979 kN (220 kips) Cars

MOMENT AND SHEAR TABLE

LOAD 4

4—AS18AM DIESELS COUPLED TO 979 kN (220 KIPS) CARS



17.72(58'1 3/4")	17.72(58'1 3/4")	17.72(58'1 3/4")	17.72(58'1 3/4")	12.80(42' 0")
1 - AS18AM	1 - AS18AM	1 - AS18AM	1 - AS18AM	979 kN(220 kips) Cars

MOMENT AND SHEAR TABLE

LOAD 5

4—AS16A DIESELS COUPLED TO 979 kN (220 KIPS) CARS

ft.	m		kN	kips
(5' 7")	1.70	↓	266.9	(60.0)
(6' 11")	2.11	↓	266.9	(60.0)
(17' 3")	5.26	↓	266.9	(60.0)
(6' 11")	2.11	↓	266.9	(60.0)
(5' 7")	1.70	↓	266.9	(60.0)
(13' 8 3/4")	4.18	↓	266.9	(60.0)
(5' 7")	1.70	↓	266.9	(60.0)
(6' 11")	2.11	↓	266.9	(60.0)
(17' 3")	5.26	↓	266.9	(60.0)
(6' 11")	2.11	↓	266.9	(60.0)
(5' 7")	1.70	↓	266.9	(60.0)
(13' 8 3/4")	4.18	↓	266.9	(60.0)
(5' 7")	1.70	↓	266.9	(60.0)
(6' 11")	2.11	↓	266.9	(60.0)
(17' 3")	5.26	↓	266.9	(60.0)
(6' 11")	2.11	↓	266.9	(60.0)
(5' 7")	1.70	↓	266.9	(60.0)
(13' 8 3/4")	4.18	↓	266.9	(60.0)
(5' 7")	1.70	↓	266.9	(60.0)
(6' 11")	2.11	↓	266.9	(60.0)
(17' 3")	5.26	↓	266.9	(60.0)
(6' 11")	2.11	↓	266.9	(60.0)
(5' 7")	1.70	↓	266.9	(60.0)
(13' 8 3/4")	4.18	↓	266.9	(60.0)
(5' 7")	1.70	↓	266.9	(60.0)
(6' 11")	2.11	↓	266.9	(60.0)
(17' 3")	5.26	↓	266.9	(60.0)
(6' 11")	2.11	↓	266.9	(60.0)
(5' 7")	1.70	↓	266.9	(60.0)
(10' 1 3/4")	3.09	↓	266.9	(60.0)
(5' 6")	1.68	↓	244.7	(55.0)
		↓	244.7	(55.0)
(5' 6")	1.68	↓	244.7	(55.0)
(6' 6")	1.98	↓	244.7	(55.0)
(5' 6")	1.68	↓	244.7	(55.0)
		↓	244.7	(55.0)

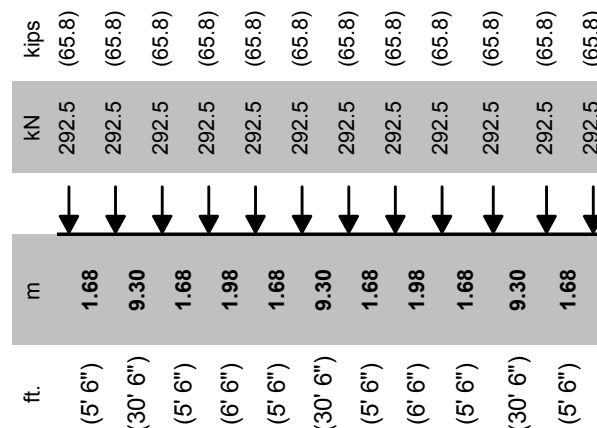
1 -

LOAD 6

1.42-39

Railroad Carrying Bridge Evaluation Program

SPAN		BENDING			END SHEAR			FLOOR BEAM REACTION		
meter	ft.	kN.m	ft-kips	E	kN	kips	E	kN	kips	E
2.44	8	178.29	131.50	65.8	383.88	86.30	62.8	438.73	98.63	56.4
3.05	10	234.29	172.80	61.4	424.09	95.34	63.6	526.45	118.35	59.2
3.66	12	317.82	234.41	58.6	450.87	101.36	57.9	584.99	131.51	56.4
3.96	13	360.23	265.69	55.9	483.70	108.74	58.9	629.96	141.62	57.5
4.27	14	402.95	297.20	54.0	511.81	115.06	59.7	668.52	150.29	57.6
4.57	15	468.50	345.55	55.3	536.19	120.54	60.3	701.93	157.80	57.7
4.88	16	535.33	394.84	56.4	557.54	125.34	59.0	731.15	164.37	57.8
5.49	18	669.00	493.43	58.1	601.18	135.15	57.9	779.91	175.33	57.8
6.10	20	802.67	592.02	57.4	658.07	147.94	59.2	818.92	184.10	56.2
7.62	25	1 196.55	882.53	57.9	760.42	170.95	60.2	888.89	199.83	52.9
9.14	30	1 636.00	1,206.65	58.8	828.66	186.29	59.1	935.91	210.40	48.8
10.67	35	2 050.34	1,512.25	57.8	877.41	197.25	57.0	969.31	217.91	44.7
12.19	40	2 496.06	1,841.00	56.2	913.98	205.47	54.5	1 023.62	230.12	42.5
13.72	45	2 941.79	2,169.75	54.2	942.40	211.86	51.0	1 111.39	249.85	42.0
15.24	50	3 387.51	2,498.50	52.9	976.87	219.61	50.2	1 228.38	276.15	42.7
18.29	60	4 278.96	3,156.00	48.5	1 089.46	244.92	49.7	1 521.25	341.99	44.5
21.34	70	5 170.41	3,813.50	44.7	1 245.10	279.91	50.7	1 804.96	405.77	45.7
24.38	80	6 240.15	4,602.50	42.5	1 421.96	319.67	50.0	2 018.02	453.67	45.4
27.43	90	7 621.89	5,621.62	42.0	1 488.33	334.59	48.8	2 204.89	495.68	45.1
30.48	100	9 360.23	6,903.75	42.7	1 585.21	356.37	47.5	2 445.05	549.67	46.1
36.58	120	13 906.63	10,257.00	44.5	1 849.88	415.87	47.8	2 996.54	673.65	49.0
42.67	140	19 255.33	14,202.00	45.7	2 086.97	469.17	47.7	3 417.75	768.34	49.7
48.77	160	24 604.03	18,147.00	45.4	2 320.59	521.69	47.6	3 933.74	884.34	51.2
54.86	180	30 242.46	22,305.69	45.1	2 580.24	580.06	48.2	4 406.54	990.63	51.8
60.96	200	37 262.62	27,483.50	46.1	2 805.54	630.71	48.1	4 884.24	1,098.02	52.2
68.58	225	47 870.88	35,307.75	48.2	3 126.17	702.79	48.7	5 506.23	1,237.85	52.9
76.20	250	59 014.01	43,526.50	49.3	3 415.48	767.83	48.8	6 104.43	1,372.33	53.2
83.82	275	70 402.29	51,926.06	49.5	3 732.99	839.21	49.3	6 717.26	1,510.10	53.5
91.44	300	83 729.46	61,755.68	50.3	4 024.88	904.83	49.4	7 323.46	1,646.38	53.7
106.68	350	114 640.50	84,554.49	51.8	4 635.67	1,042.14	50.0	8 543.48	1,920.65	54.0
121.92	400	148 872.19	109,802.49	52.2	5 245.83	1,179.31	50.4	9 762.65	2,194.73	54.2



|14.63(48' 0")|14.63(48' 0")|14.63(48' 0")|